



## Early-Season Drought Stress in Corn

While the greatest need for water in corn occurs during the later vegetative stages, early season drought stress can affect corn in ways that last the entire year. Drought conditions early on can hamper emergence, causing uneven stands, and can negatively impact ear length, overall leaf area, root growth, and root development.

### Impact on Germination<sup>1</sup>

At planting, dry conditions within the seed zone can lead to uneven germination and emergence across the field. This is particularly true when the seeding depth is variable, and some seeds are planted in areas with inadequate moisture. Corn seeds must absorb about twice their weight in water to initiate the germination process, so seeds exposed to different moisture levels will have different germination times. Drastic differences in emergence can lead to late-emerging seedlings essentially becoming weeds, plants that will be outcompeted for resources to the extent that their yield contribution is significantly reduced (Figure 1). Inspecting the soil condition at seed depth is important in dry conditions. Sometimes you may have to plant deeper than you intended to so that the seed is placed in consistent soil moisture.



Figure 1. Uneven development from variable emergence.

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## Impact on Roots<sup>2,3</sup>

Dry soil and hot air temperatures (above 80 °F, above 26 °C) can raise the soil temperature to a level that kills the developing roots of corn seedlings. At the V3 stage, a corn plant is beginning to switch from relying on resources provided by the seed it grew from to relying on resources provided by its developing leaves and nodal roots, making it very susceptible to root death. Roots killed in this manner take on a “roasted” or burnt appearance. In cases where the entire whorl set of roots is killed, moisture uptake by the nodal system must be delayed until another whorl set becomes established. This may lead to what is referred to as “floppy corn” (Figure 2). As the name implies, the plant is without the anchoring system provided by the nodal roots, forcing it to rely on the strength of the mesocotyl to remain upright. Winds that result in breaking or bending the mesocotyl can then cause the plant to simply flop over.



**Figure 2. Floppy corn syndrome.**

There is not much that can be done once the plant has lodged. However, there are some steps that can be taken to help prevent floppy corn syndrome. Ensure that the minimum seeding depth is at least 2 (5 cm) to 2.5 inches (6.4 cm). Try to eliminate soil compaction by not tilling fields that are too wet or not planting when soil conditions are not fit. Make sure that the seed slot is completely collapsed at planting, not open (Figure 3).



**Figure 3. Planting under wet conditions can result in an open seed furrow.**



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## Impact on Leaves<sup>4,5</sup>

Early season development, up to the V8 stage, determines the size of the overall plant and the size of each leaf. Drought stress at this critical time period will reduce both plant and leaf size (Figure 4). A small reduction in leaf size will not have a significant impact on yield, but the more that leaf size is reduced the less photosynthetic area that will be available to contribute to yield. Extended drought that results in burned leaves and leaf death can significantly reduce yield potential. A common sight when corn is experiencing drought stress is leaf rolling. Four consecutive days of leaf rolling when corn is in early growth stages through V12 may reduce yield potential by 1% to 3% per day of stress.



Figure 4. Drought-related stunting.

## Impact on Ear Length and Kernel Row Number<sup>4,5,6</sup>

Drought stress that occurs between V6 to V8 can impact the number of kernel rows. While this trait is genetically controlled, its expression can be modified by the environment. If the corn product is genetically predisposed to have 18 kernel rows but ends up having less than that, the reduction is most likely due to stress that occurred between the V6 to V8 growth stages. In an ear that has 16 kernel rows around, loss of one kernel row equates to about a 5 bushels loss per acre of yield with an average plant population. Additionally, the number of kernels per row may be established as early as V5 and continues to be environmentally influenced throughout pollination and grain fill. Thus, early season drought stress may reduce both the number of rows and the number of kernels within a row.

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## Sources

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- <sup>2</sup>Nielsen, R.L. 2020. Root development in young corn. Purdue University Extension. Corny News Network. <https://www.agry.purdue.edu/ext/corn/news/timeless/Roots.html>
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- <sup>6</sup>Nielsen, R.L. 2023. Ear size determination in corn. Purdue University Extension. Corny News Network. <https://www.agry.purdue.edu/ext/corn/news/timeless/EarSize.html>

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The recommendations in this material are based upon trial observations and feedback received from a limited number of growers and growing environments. These recommendations should be considered as one reference point and should not be substituted for the professional opinion of agronomists, entomologists or other relevant experts evaluating specific conditions.

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